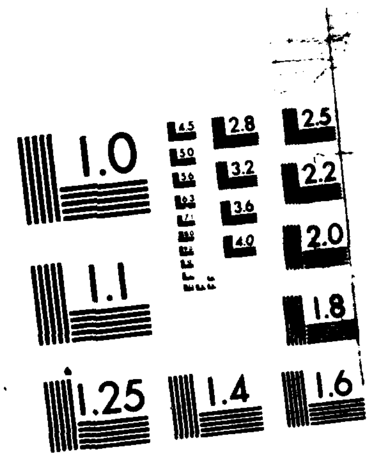
AD-A166 481 REPORT ON THE UPDATING OF WORKLOAD FACTORS FOR THE DLA MOBILIZATION PLAN(U) DEFENSE LOGISTICS AGENCY ALEXANDRIA VA OPERATIONS RESEARCH AND ECONOMIC ANALYSIS OFFICE S G NAIMON JUL 85 1/1

UNCLASSIFIED F/G 15/5 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 196_-A

AD-A166 481

DEPARTMENT OF DEFENSE

DEFENSE LOGISTICS AGENCY

REPORT ON THE UPDATING OF WORKLOAD FACTORS FOR DLA MOBILIZATION PLAN

Cameron Station,
Alexandria, Virginia 22304 6100

DTIC FILE COPY

DTIC ELECTE APR 0 9 1986 S D E

July 1985

86 4 9 127

Report on the Updating of Workload Factors for the DLA Mobilization Plan

July 1985

RE: Distribution Statement
Approved for Public Release. Distribution Unlimited.
Per Ms. Cleo Ridgeway, Defense Logistics Agency/LO

Accession For	
NTIS GRA&I	X
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

Stanley G. Naimon
Operations Research and Economic Analysis Office
Headquarters, Defense Logistics Agency
Alexandria, Virginia 22304-6100

DEFENSE LOGISTICS AGENCY
HEADQUARTERS
CAMERON STATION
ALEXANDRIA, VIRGINIA 22314

DLA-LO

July 1985

FOREWORD

This report documents and summarizes the work done and conclusions reached during the DLA Operations Research and Economic Analysis Management Support Office's (DLA-LO(DORO)) review of workload factors for the revised DLA Mobilization Plan (DLAMP). The study was performed at the request of the Command, Control, and Contingency Plans Division of DLA.

In place of the Department of Defense Materiel Distribution System Study's (DODMDSS) demand factors which formed the basis for the current DLAMP, the DLA Inventory Data Bank and Service-provided Time Phased Force Deployment Data served as the main sources for the study. The Uniform Standard Automated Materiel Management System Inventory Management Simulation (USIMS) was then used to derive key Inventory Control Point and depot workload factors. These workload factors will be used by DLA Inventory Control Points and depots to assess any resource shortfalls in the event of a full mobilization.

~~In addition,~~ The report offers three major recommendations. First, more complete data should be obtained from the Services for future updates of the DLAMP. Second, a working group should be established within DLA to focus on and to evaluate mobilization policies. ~~Finally~~ Third, for future mobilization planning efforts, earlier review by mobilization planners at the field activities of the computer simulation output should occur to increase the validity of the simulation results.

Roger C. Roy

ROGER C. ROY
Assistant Director
Policy and Plans

Contents

List of Tables

List of Tables

List of Figures

I. INTRODUCTION

A. Background

The current DLA Mobilization Plan (DLAMP) is based on workload projections under a full mobilization scenario. These workload projections were derived by executing the Uniform Standard Automated Materiel Management System (SAMMS) Inventory Management Simulation (USIMS) with demand quantity factors taken from the Department of Defense Materiel Distribution Study (DODMDSS) of the mid 1970s and requisition frequency estimates made by the DLA Operations Research and Economic Analysis Management Support Office (DORO) in the late 1970s.

With the recent emphasis on mobilization planning throughout the DoD and the emergence of the Time Phased Force Deployment Data (TPFDD) approach, new demand data have become available on a limited basis. The Services have developed their materiel requirements for certain critical items, known to be needed in the event of a mobilization, by time increments based on the troop deployment schedule. The Command, Control and Contingency Plans Division chose to update the DLAMP with factors derived from this new source of mobilization data, and requested that DORO develop new workload planning factors to be used by DLA activities in determining their resource requirements in the event of a mobilization.

B. Objectives. The major objective of this study was to update both the DLA Inventory Control Point (ICP) and DLA Defense Depot workload planning factors provided in the DLAMP. By using the most current factors, planners will be able to develop more realistic and accurate estimates of resource shortfalls and devise better mobilization plans. Figure 1 shows a schematic overview of the mobilization planning process. In this analysis, USIMS is used to derive ICP workload and performance indicators; these are compared to surge capacities at DLA activities; finally, mobilization capabilities and requirements are determined from this comparison.

C. Scope

1. The Construction, Electronics, General, Industrial and Medical commodities were examined in the study in detail by simulation with the USIMS model, which is described in brief in Appendix A. All DLA depots were considered. A listing of depots and ICPs with their common abbreviations is presented in Table 1.

2. The three major Services (Army, Air Force, and Navy) were examined.

3. A full mobilization scenario for which the TPFDD existed was chosen by the Command, Control and Contingency Plans Division. Data from from the DLA Inventory Data Bank (DIDB) for the quarter ending in December 1984 and USIMS extracts from the same time frame were used with the

exception of DGSC. For DGSC, USIMS extracts from March 1985 were required.

4. The factors for the 30, 60, and 90 day intervals were sought.

Figure 1

SCHEMATIC OVERVIEW OF MOBILIZATION PLANNING

```
                                          SURGE CAPACITY
                                                |
                                                |
                                                |
       __________                     __________V__________
      |          |                   |                     |
      |  USIMS   |----workload------>|   SUPPLY            |
      |          |                   |                     |
      |          |----performance--->|  OPERATIONS         |
      |__________|                   |_____________________|
                                                |
                                                |
                                                |--------> MOBILIZATION
                                                           REQUIREMENTS
                                                           and
                                                           CAPABILITIES
```

II. METHODOLOGY

The overall increase in requisition sizes and requisition volume incoming to the DLA ICPs was quantified by using TPFDD demands and comparing these to the historical demands. The USIMS model was then employed to determine the impact on key workload indicators for both ICPs and depots that would result from these increases.

The project involved the following steps:

(1) refinement of input data to the USIMS model, explained in sections II A, II B, and in Appendix B;

(2) execution of two scenarios, normal and mobilization, discussed in section II D; and

(3) the derivation of key workload factors - ICP workload factors are explained in the section III, Analysis, and depot workload factors are clarified in Appendix C.

Figure 2 shows a schematic view of the derivation of workload planning factors for ICPs and depots.

Table 1

Common Abbreviations For DLA Depots And Inventory Control Points (ICPs)

Name	Abbreviation
ICP	
Defense Construction Supply Center	DCSC
Defense Electronics Supply Center	DESC
Defense General Supply Center	DGSC
Defense Industrial Supply Center	DISC
Defense Personnel Support Center (Medical)	DPSC-M
Defense Personnel Support Center (Clothing and Textile)	DPSC-T
Defense Depots	
Defense Construction Supply Center	DCSC
Defense Depot Mechanicsburg Pennsylvania	DDMP
Defense Depot Memphis Tennessee	DDMT
Defense Depot Ogden Utah	DDOU
Defense Depot Tracy California	DDTC
Defense General Supply Center	DGSC

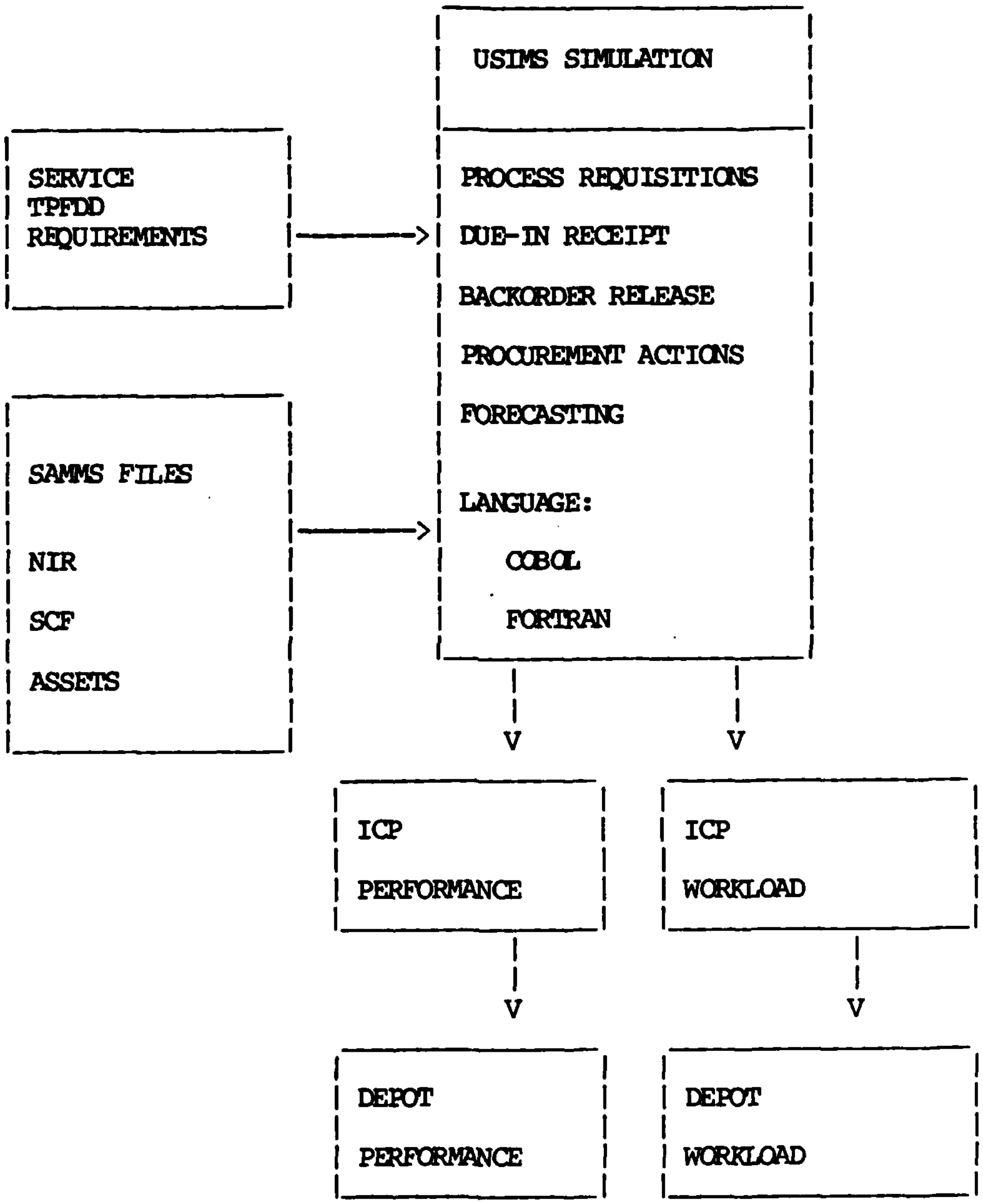
A. Data And Assumptions

The major sources for the data needed in this study were the DIDB, SAMMS quarter end USIMS extracts files, and the TPFDD provided by the Services. Other sources utilized included DLA Headquarters staff, ICP staff, and various management information reports.

There were a number of limitations of the TPFDD. Data for all Services were only available for the Medical commodity. Only Army demands were available for the other commodities. The TPFDD excluded demands for units within the continental United States (CONUS).

Figure 2

SCHEMATIC OF THE DERIVATION OF MOBILIZATION WORKLOAD PLANNING FACTORS



A number of key assumptions were made in obtaining TPFDD requisition frequency and size factors. It was assumed that (1) only TPFDD items would experience demand during a mobilization and (2) those identified TPFDD National Stock Numbers (NSNs) would experience demand increases for other Service users in proportion to the increase in demand registered in the case of the Army. For example, if the Army normal usage were 10 requisitions for a total quantity of 100 and the TPFDD demands amounted to 10 requisitions for another 100, the other Services' demands would increase proportionally, that is double.

It was also assumed that other items, not specifically identified in the TPFDD, would also experience increases in demands. Initially, demand increases to the TPFDD NSNs were thought to represent the only increases in demand. Upon application of this assumption, as shown in Appendix B, it became apparent that this choice grossly understated the true increases in demand frequency and quantity expected in a mobilization. Thus, the original assumption became untenable and the assumption of across the board increases was adopted.

Mobilization parameters for USIMS runs were discussed with representatives of Supply Operations and the Command, Control, and Contingency Plans Division. No source could identify any policy change that would be implemented in a mobilization environment. It was, therefore, assumed that internal SAMMS policies would not be altered during a mobilization. The only changes to the input parameters needed for the mobilization scenario runs of USIMS would involve the external influences. These would include the changes to the requisition size and frequency, and changes in the area of returns. A mobilization would result in decreases in quantity, frequency, and likelihood of items being returned to the depots. Table 2 shows the peacetime and mobilization scenario adjustments to the computer simulation for returns. These were the same factors developed previously by DORO and applied in execution of USIMS for the previous DLAMP.

B. <u>Refinement Of Input Data To The USIMS Model</u>. The refinement of the TPFDD from the two scenarios selected by the Command, Control, and Contingency Plans Division as representing a full scale mobilization consisted of a series of steps. Each involved computer programs to manipulate data from DIDB item and demand files and records of the TPFDD. The TPFDD data were summarized to obtain the total quantity and frequency demanded during the 90 day mobilization period for each TPFDD NSN. The DIDB was used to establish a baseline of normal demand to which the new scenario could be compared. The factors for the TPFDD NSNs derived in this process were employed in conjunction with other assumptions, as explained in Appendix B, to complete the refinement of input data for the USIMS model.

Table 2

COMPUTER SIMULATION ADJUSTMENTS FOR RETURNS

POLICY DESCRIPTION	PEACETIME VALUE	MOBILIZATION VALUE
RETURNS PROBABILITY (CREDITABLE)	.66	.1
RETURNS PROBABILITY (NON-CREDITABLE)	.635	.1
LATE RETURNS PROBABILITY	.416	.1
RETURNS FREQUENCY	1.0	.1
RETURNS QUANTITY	1.0	.1

C. Limitations Of The USIMS Model. The USIMS model has a number of inherent limitations, as does any simulation model. While increasing the number of executions of the simulation increases statistical confidence in the accuracy of the model's output, the numbers generated from any simulation should never be construed as being real data. By comparing two scenarios one can hope to eliminate some concerns. As with any simulation, not all processes that impact on operations can be completely modelled. Simplifying assumptions are always necessary for all but the simplest situations. However, even with these known limitations, USIMS was judged to be the most appropriate tool available to conduct this analysis.

D. Execution Of Two Scenarios. The main idea underlying this application of the computer simulation was to compare normal ICP and depot operations to some hypothesized situation. Four baseline runs of USIMS for each ICP were made to simulate normal operations over the course of 24 months. USIMS parameter cards were provided by the ICPs. With the environmental factors described in section A above as the mobilization scenario parameters, the model was executed four more times for each commodity, again with a simulation run length of 24 months. The mobilization was assumed to occur in month 13 to allow the system to stabilize and overcome any initialization bias. The monthly values of interest focused on the thirteenth, fourteenth, and fifteenth months. The simulation was allowed to continue through the twenty-fourth month to check supply availability over the 12 month time frame.

III. ANALYSIS

A. Workload Factors

After both the baseline and mobilization scenarios had been executed, derivation of key ICP workload factors followed. For each commodity and each month, the workload planning factor was derived by summing four like runs for both scenarios and dividing the mobilization sum by the baseline sum. These values are shown in Tables 3 through 5. The factors represent a ratio of the mobilization values and the baseline values determined from the simulation. To derive a projected mobilization workload, one must multiply the appropriate factor by an appropriate average monthly value or a selected month's actual value. Assume, for example, that the normal monthly number of buys at DCSC is a constant 5000. From Tables 3, 4, and 5, the 30, 60, and 90 day factors for DCSC are:

1.6, 3.2, and 3.4.

The mobilization workload projected for the respective periods would be:

$$1.6 \times 5000 = 8000$$

$$3.2 \times 5000 = 16000$$

$$3.4 \times 5000 = 17000.$$

The determination of workload factors for the depots was accomplished in a slightly different manner. Monthly results of the simulation runs were compared with data contained in DLA management information reports to obtain these factors. Therefore, unlike the factors for the ICPs, these factors used actual workloads and not the simulated baseline as for the ICPs. The baseline workload came from average monthly workload at each depot for fiscal year (FY) 1984. The final depot workload factors are presented in Tables 6 through 8. Details of the method used to arrive at these figures are presented in Appendix C.

Table 3

ICP WORKLOAD FACTORS FOR THE FIRST 30 DAYS (M + 1)

Key Indicator	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	DPSC-T
Requisition Frequency	2.3	5.7	3.0	2.7	1.4	2.2
Requisition Quantity	2.4	1.6	1.3	2.2	2.0	1.4
Value of Recurring Demand	2.2	2.2	1.3	2.1	1.7	-
Value of non-Recurring Demand	2.2	2.1	1.3	2.2	2.0	-
Value of Net Sales	1.8	2.1	1.3	1.9	1.8	-
Total Number of Purchase Requests (PRs)	1.6	1.7	1.1	1.6	1.6	-
Number of PRs < 25 K	1.6	1.7	1.1	1.2	1.5	-
Number of PRs > 25 K	1.7	1.8	1.6	1.6	1.9	-
Value of Commitments	1.5	1.6	1.2	1.6	1.7	-
Value of Obligations	1.0	1.0	1.2	1.0	0.9	-
Supply Availability	0.95	0.99	0.99	0.98	0.95	-
Value of Stock on Hand	0.92	0.94	0.97	0.92	0.89	-
Value of Safety Level	1.0	1.0	1.0	1.0	1.0	-
Value of Economic Order Quantity	1.0	1.0	1.0	1.0	1.0	-
Value of Quarterly Forecast Demand	1.0	1.0	1.0	1.0	1.0	-
Number of Items with Backorders	1.3	1.3	1.2	1.3	1.5	-
Average Number of Backorders per day	1.3	1.5	1.1	1.2	1.2	-
Migration						
Low to High	-	-	-	-	-	-
NSO to Replenishment	-	-	-	-	-	-

Table 4

ICP WORKLOAD FACTORS FOR THE SECOND 30 DAYS (M + 2)

Key Indicator	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	DPSC-T
Requisition Frequency	2.3	5.7	3.0	2.7	1.4	2.2
Requisition Quantity	2.4	1.6	1.3	2.2	2.0	1.4
Value of Recurring Demand	2.7	3.1	1.6	2.7	2.0	-
Value of non-Recurring Demand	2.5	2.7	1.7	2.2	1.9	-
Value of Net Sales	1.9	2.5	1.4	2.0	1.6	-
Total Number of Purchase Requests (PRs)	3.2	4.3	2.2	3.8	2.3	-
Number of PRs < 25 K	3.2	4.2	2.2	3.6	2.8	-
Number of PRs > 25 K	3.5	6.2	2.0	3.8	2.2	-
Value of Commitments	4.3	6.5	1.7	3.6	2.8	-
Value of Obligations	1.1	1.1	1.1	1.1	1.5	-
Supply Availability	0.87	0.95	0.98	0.94	0.84	-
Value of Stock on Hand	0.83	0.85	0.93	0.83	0.83	-
Value of Safety Level	1.0	1.3	1.3	1.0	1.1	-
Value of Economic Order Quantity	1.0	1.1	1.0	1.0	1.1	-
Value of Quarterly Forecast Demand	1.0	1.2	1.4	1.0	1.1	-
Number of Items with Backorders	1.9	2.0	1.5	1.8	2.0	-
Average Number of Backorders per day	2.0	3.1	1.9	1.8	2.0	-
Migration						
Low to High	-	-	-	-	-	-
NSO to Replenishment	-	-	-	-	-	-

Table 5

ICP WORKLOAD FACTORS FOR THE THIRD 30 DAYS (M + 3)

Key Indicator	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	DPSC-T
Requisition Frequency	2.3	5.7	3.0	2.7	1.4	2.2
Requisition Quantity	2.4	1.6	1.3	2.2	2.0	1.4
Value of Recurring Demand	2.7	3.3	1.6	2.8	1.9	-
Value of non-Recurring Demand	2.6	3.0	1.7	2.5	2.0	-
Value of Net Sales	1.9	2.5	1.5	2.0	1.1	-
Total Number of Purchase Requests (PRs)	3.4	5.0	2.1	3.6	2.4	-
Number of PRs < 25 K	3.5	4.8	2.0	3.5	2.3	-
Number of PRs > 25 K	3.0	8.7	2.2	3.8	2.8	-
Value of Commitments	3.5	11.0	2.1	4.3	3.2	-
Value of Obligations	1.2	1.3	1.0	1.1	1.9	-
Supply Availability	0.78	0.90	0.96	0.89	0.73	-
Value of Stock on Hand	0.75	0.77	0.90	0.75	0.76	-
Value of Safety Level	1.0	1.6	1.1	1.1	1.2	-
Value of Economic Order Quantity	1.0	1.2	1.1	1.0	1.2	-
Value of Quarterly Forecast Demand	1.0	1.4	1.1	1.1	1.2	-
Number of Items with Backorders	2.5	2.9	1.7	2.3	2.7	-
Average Number of Backorders per day	3.0	5.4	2.6	3.0	3.1	-
Migration						
Low to High	3.5	4.4	2.1	3.5	3.5	-
NSO to Replenishment	1.9	3.2	1.9	2.0	1.7	-

Table 6

DEPOT WORKLOAD FACTORS FOR THE FIRST 30 DAYS (M + 1)

Key Indicator	Defense Depot					
	DCSC	DDMP	DDMT	DDOU	DDTC	DGSC
Receipt Lines In	.9	1.1	1.1	1.0	1.0	1.1
Receipt Tons In	.9	1.1	1.1	1.0	1.0	1.1
Materiel Release Order Lines	2.2	2.3	3.6	3.2	2.1	3.2
MRO Lines with Service-owned Assets	2.2	3.0	3.7	3.2	2.7	3.2
Tons Out	1.8	1.7	1.5	1.5	1.6	1.3
Tons Out with Service-owned Assets	1.8	2.4	1.6	1.5	2.0	1.3

Table 7

DEPOT WORKLOAD FACTORS FOR THE SECOND 30 DAYS (M + 2)

Key Indicator	Defense Depot					
	DCSC	DDMP	DDMT	DDOU	DDTC	DGSC
Receipt Lines In	.9	1.0	.9	.9	.9	.9
Receipt Tons In	.9	1.0	.9	.9	.9	.9
Materiel Release Order Lines	2.7	2.6	4.5	3.7	2.6	3.8
Tons Out	1.9	1.7	1.6	1.7	1.8	1.5

Table 8

DEPOT WORKLOAD FACTORS FOR THE THIRD 30 DAYS (M + 3)

Key Indicator	Defense Depot					
	DCSC	DDMP	DDMT	DDOU	DDTC	DGSC
Receipt Lines In	.9	.9	.9	.9	.9	1.0
Receipt Tons In	.9	.9	.9	.9	.9	1.0
Materiel Release Order Lines	2.1	2.4	3.8	3.5	2.3	3.9
Tons Out	1.8	1.5	1.5	1.7	1.6	1.6

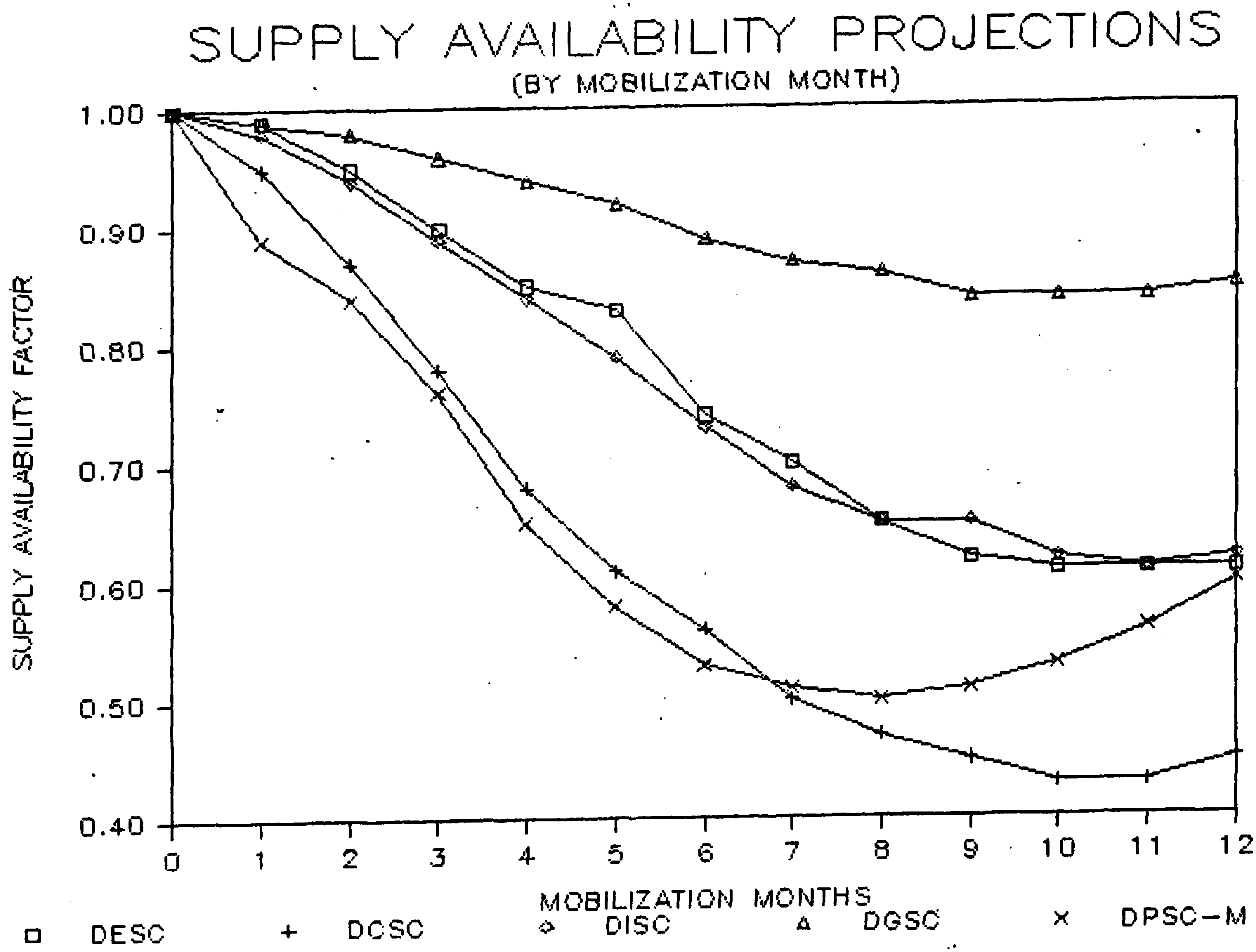
B. Other Issues

While the major concern of this study was to derive workload factors for the first 90 days of a mobilization, two other issues surfaced during the course of the project. For one, the Command, Control, and Contingency Plans Division also desired to examine supply availability over the mid-term horizon. These factors are presented in Figure 3. These values are similar to the ICP workload factors in that they represent the decrease in availability compared to the normal situation. If, for example, at the time of the mobilization the supply availability at DCSC is actually 89 %, the workload planning factor of .95 for the first month would be multiplied by 89 % giving a projected supply availability of about 84.6 % (89 x 95 = 84.6).

Another point of concern was that there appears to be a need to look into how to improve system performance during a mobilization. For instance, what policy changes are required to make SAMMS react more quickly to changes in the environment arising in a mobilization scenario? Or, how can the expenditure of funds for stocks that will arrive too late to be of any use in a short-lived mobilization be counter-acted when demand suddenly drops off to normal levels after the mobilization period?

IV. CONCLUSIONS

While the TPFDD provided more modern estimates of both quantity and frequency, it is not without its limitations. In the first place, this source represents only the overseas demand and is used for predicting air and sea transportation requirements. In view of the sparsity of data, the accuracy of the factors derived is certainly questionable. Questions concerning the other items' mobilization demand must also arise. These questions require the imposition of various assumptions which are all



SUPPLY AVAILABILITY PROJECTIONS
(BY MOBILIZATION MONTH)
SUPPLY AVAILABILITY FACTOR
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0
1
2
3
4
5
6
7
8
9
10
11
12
MOBILIZATION MONTHS
DESC
DCSC
DISC
DGSC
DPSC-M

FIGURE 3

subject to a large degree of skepticism. In the absence of more substantial and complete data from the Services, the derivation of demand quantity and frequency factors will remain nebulous. Based on current available data, the mobilization factors reflected in this report represent the best estimates that DLA can provide of the increases in workload arising from demand increases under mobilization.

The Clothing and Textile commodity deserves special mention. It will be noticed that a column has been included in the ICP workload factors for DPSC-T. While both TPFDD and DIDB information were available and were processed, no means currently exist to simulate ICP operations for Clothing and Textile. Planners at DPSC-T might be able to provide an initial estimate of workload at their ICP. Without the ICP estimates, planning factors for the depots excluded any additional workload arising from DPSC-T.

Recently, there have been some discussions within Supply Operations as to possible policy changes in the event of a mobilization. At this time, no concrete decisions have been made. USIMS could provide a possible means of testing how any contemplated policy changes might perform in a mobilization scenario. With the participation of ICP planners and Operations Research analysts, policy changes could be discussed and analyzed in a more objective manner.

Finally, the dramatic changes that can be anticipated in the event of a full scale mobilization suggest the need for more active management on the part of DLA Headquarters, ICP, and depot planners. Such meetings should enhance the validity of the study by providing feedback from field activities.

V. RECOMMENDATIONS

In view of the preceding conclusions, the following recommendations are provided to update the DLAMP in the future and to improve mobilization planning in DLA in general:

* Obtain TPFDD from all Services for all DLA commodities that are to be simulated.

* Obtain continental United States (CONUS) demand estimates or records for those commodities cited above from the Services.

* Have the Services clarify the status of other items not identified in the foregoing two points.

* Involve DPSC-T planners in the event that a Clothing and Textile simulation is unavailable for the next update of these workload planning factors. In either case, planning factors for Clothing and Textile should be included in the next revision of DLAMP workload planning factors.

* Establish a working group within DLA to review and discuss possible policy changes that should take effect in the event of a mobilization. It may also be possible to simulate these policy changes and compare results of alternative policies using USIMS and the techniques applied in this study.

* Facilitate the interplay of more participants to ensure that ICP and depot experts can interact with computer simulation output and provide feedback for use in the simulation.

Appendix A

Description Of USIMS

The USIMS model has been a part of SAMMS since 1974. It is available at Headquarters and all DLA supply centers except Clothing and Textile and Subsistence. It can be used to simulate various inventory policies. The simulation is based on actual item asset values and demand history which are extracted from SAMMS files quarterly. Normally about 5000 items are used as a sample for the model; the results for these items are scaled to population values to determine overall performance. Although 80 different output reports are produced, only about half are of primary interest in mobilization planning. The USIMS model has recently been enhanced to improve its accuracy. The simulation portion of the model is a FORTRAN Monte Carlo simulation. A complete set of USIMS documentation is available from DLA-LO(DORO) C/O DGSC, Richmond, Virginia 23297-5000 upon request.

Appendix B

Use Of Time Phased Force Deployment Data To Derive Requisition Frequency And Quantity Factors

The derivation of factors to represent the increase in demand quantity and frequency is clouded by the lack of complete data. Some facts pertaining to the TPFDD items are presented in Table B-1. For instance, DPSC-M

Table B-1

TIME PHASED FORCE DEPLOYMENT DATA ITEMS

	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	DPSC-T
Number of Items (stocked and non-stocked)	533050	1000410	289211	919500	40800	30340
Number of Items with TPFDD	1671	9819	1550	1363	4084	628
Percent of Items with TPFDD	< 1	1	< 1	< 1	10	2
Number of Requisitions (stocked and non-stocked in millions)	3.8	4.4	2.8	6.5	1.5	2.4
Number of Requisitions with TPFDD Requisitions added to Normal Requisitions (in millions)	4.4	10.5	4.0	7.0	2.0	3.4
Normal Requisition Frequency of TPFDD Items as Compared to Frequency for all Items for the ICP (a percent)	10	16	12	2	56	19

represents the ICP with the most complete data, but only 10 percent of all items and about 56 percent of all ICP requisitions were involved. At the other ICPs, the TPFDD items usually accounted for less than one (1)

per cent of the items. The largest increase in requisition volume was registered at DESC, which had 250 % of the normal volume (10.5 versus 4.4 million). DISC experienced the lowest rise, eight per cent rise (7.0 million versus 6.5). Other ICPs showed only modest increases (less than 50 per cent). The original assumption that one could simply add the TPFDD requisition numbers to the requisitions for the population at the ICP did not reflect the surge in demands that would arise in the event of a full mobilization. A similar analysis was conducted on the average requisition sizes with similar results, that is, most ICPs showed little change in requisition sizes. These results of only slight increases seemed incongruous with normal perceptions of mobilization.

The original assumption of simple additivity was discarded as unsatisfactory. Since other items and CONUS destinations would be involved in a mobilization, the TPFDD would need to be augmented. While efforts were made by DLA Headquarters planners to obtain more data from the Services, it became apparent that more precise and complete data could not be available to accomplish this study. Therefore, some other approach to derive mobilization demand data would be necessary.

The method chosen to determine the factors for demand quantity and frequency for each ICP involved combining the TPFDD factors and estimating factors for other items not included in the TPFDD. The requisition size and frequency factors for the TPFDD NSNs are shown in Tables B-2 and B-3.

Table B-2

REQUISITION FREQUENCY CHARACTERISTICS FOR TIME PHASED FORCE DEPLOYMENT DATA ITEMS

	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	DPSC-T
Normal Annual Frequency (000s)	238	687	329	140	845	466
Frequency with TPFDD (000s)	858	7093	1601	621	1402	1548
Frequency Factor	3.61	10.32	4.67	4.44	1.66	3.32

Table B-3

REQUISITION SIZE CHARACTERISTICS FOR TIME PHASED FORCE DEPLOYMENT DATA ITEMS

	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	DPSC-T
Normal Average Requisition Size	6	11	54	110	28	148
Average Requisition Size with TPFDD	22	25	83	375	79	269
Size Factor	3.67	2.27	1.54	3.41	2.82	1.82

It was arbitrarily assumed that the demand sizes and frequencies for other items would increase at half the rate of increase of the TPFDD NSNs identified in the commodity. The weighted average for the commodity was then calculated by combining the TPFDD percent of increase for those items so identified and half the rate of increase for the remainder of the population. Table B-4 shows an example of the calculations for the Construction commodity. The values in Table B-5 are the commodity specific factors for all ICPs. These factors were applied uniformly for each month simulated.

Table B-4

EXAMPLE OF A DERIVATION OF FACTORS FOR REQUISITION FREQUENCIES AND SIZES USING THE TIME PHASED FORCE DEPLOYMENT DATA FOR DEFENSE CONSTRUCTION SUPPLY CENTER

Frequency Factor for TPFDD Items	3.61	
Frequency Factor for non-TPFDD Items	1.00	
Sum	4.61	
Divide by 2	2.305	Frequency Factor for other items
Size Factor for TPFDD Items	3.67	
Size Factor for non-TPFDD Items	1.00	
Sum	4.67	
Divide by 2	2.335	Size Factor for other items
Percent TPFDD Items in Population	.01	(used as minimum value)
Percent non-TPFDD Items in Population	.99	(100 % minus above line)

Commodity Factors

Size:

(.01 * 3.61) + (.99 * 2.305) =

.0361 + 2.28195 = 2.31805 rounded to 2.32 for the simulation

rounded to 2.3 for Table B-5

Frequency:

(.01 * 3.67) + (.99 * 2.335) =

.0367 + 2.31165 = 2.3485 rounded to 2.35 for the simulation

rounded to 2.4 for Table B-5

Table B-5

TIME PHASED FORCE DEPLOYMENT DATA DERIVED FACTORS FOR REQUISITION FREQUENCIES AND SIZES

	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	DPSC-T
Frequency Factor	2.3	5.7	3.0	2.7	1.4	2.2
Requisition Quantity	2.4	1.6	1.3	2.2	2.0	1.4

Appendix C

Derivation Of Depot Workload Factors

The derivation of depot workload factors presented more problems than the ICP factors. Since USIMS does not simulate depots, a method of translating results from USIMS to a depot level was necessary. The key depot indicators — Materiel Release Orders (MROs) processed, receipt lines processed, and tons of issues and receipts — are not specifically available from USIMS outputs.

To ascertain the depot workload planning factors, USIMS output reports for total requisitions, supply availability, value of net sales, value of receipts from procurement, and value of receipts from returns, served as the intermediate results. These were then transformed using actual depot workload data from the recent past. It was assumed that mobilization workload would impact the depots in proportion to the past workload experienced by commodity. Information provided by DLA Supply Operations on the short tons shipped and received and MRO lines shipped for fiscal year (FY) 1984 are shown in Tables C-1 through C-3. These values were used as the baseline in calculating new workload planning factors for the depots.

Table C-1

SHORT TONS RECEIVED ANNUALLY BY DEPOT AND COMMODITY
(in 000s)

Depot	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL
DCSC	13.8	0	2.7	5.4	0	21.9
DDMP	4.8	.6	8.9	16.2	20.0	50.5
DDMT	8.9	0	50.0	14.7	12.8	86.4
DDOU	10.5	1.9	38.5	4.1	.4	55.4
DDTC	9.2	.3	26.0	15.8	14.2	65.5
DGSC	.9	1.0	51.5	.2	0	53.6

Table C-2

SHORT TONS SHIPPED ANNUALLY BY DEPOT AND COMMODITY
(in 000s)

Depot	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL
DCSC	15.6	0	2.7	5.5	0	23.8
DDMP	4.2	.4	15.6	18.0	22.1	60.3
DDMT	7.9	.1	43.9	16.5	12.4	80.8
DDOU	10.8	2.9	27.0	5.1	.1	45.2
DDTC	10.9	.3	37.3	18.8	13.5	79.8
DGSC	.9	1.8	54.7	0	0	57.4

Table C-3

LINES SHIPPED ANNUALLY BY DEPOT AND COMMODITY
(in 000s)

Depot	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL
DCSC	843.3	.1	7.3	1412.6	0	2263.3
DDMP	271.7	404.9	96.5	261.6	619.0	1653.7
DDMT	568.8	.5	517.8	1450.4	421.8	1659.3
DDOU	684.6	1831.2	100.7	1208.3	1.6	3826.4
DDTC	201.0	153.8	604.5	533.5	431.9	1924.7
DGSC	3.3	855.8	724.9	2.0	0	1586.0

The intermediate results essential for the derivation of the depot workload factors and the transformations are presented in tables C-4 through C-6.

The total requisitions was multiplied by the supply availability to obtain the number of MROs sent to all depots. The number of back order releases, which is not available in USIMS but also contributes to the number of MROs, was viewed as a neutral factor in determining MROs shipped. The net sales, which does include backorder releases, was used to determine tons shipped. The dollar value of both procurements and returns were added to determine the tons received.

Another assumption was needed to accomplish the derivation of ton data. This assumption was that a fixed dollar amount of assets (shipped or received) for each commodity equates to one ton. For instance, assume a simple scheme with one ICP and two depots and $1000 per ton as the fixed ratio for the commodity. Also suppose that mobilization workload factor for the net sales in the first month is 1.8. Assume further that depot A normally ships one ton per month and depot B 10 tons per month, or, equivalently, $1,000 and $10,000 respectively. During mobilization the ICP factor would be applied to both depots resulting in 1.8 tons and $1,800 shipped from depot A and 18 tons or $18,000 shipped from depot B. Commodity specific weight factors are not included in the tables, since these changes are all relative to the dollar values of the commodities being stocked at the particular depot.

Table C-4

SELECTED ICP WORKLOAD FACTORS FOR THE FIRST 30 DAYS (M + 1)

Key Indicator	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	DPSC-T
Total Requisitions	2.0	4.3	2.0	2.3	1.4	-
Supply Availability	0.95	0.99	0.99	0.98	0.95	-
Calculated Total MRO Lines	1.9	4.3	1.9	2.2	1.3	-
Value of Net Sales	1.8	2.1	1.1	1.9	1.8	-
Calculated Value of Receipts	.84	.77	1.1	.88	1.3	-

Table C-5

SELECTED ICP WORKLOAD FACTORS FOR THE SECOND 30 DAYS (M + 2)

Key Indicator	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	DPSC-T
Total Requisitions	2.3	5.2	2.7	3.3	1.4	-
Supply Availability	0.87	0.95	0.98	0.94	0.84	-
Calculated Total MRO Lines	2.0	4.8	2.7	3.1	1.2	-
Value of Net Sales	1.9	2.5	1.4	2.0	1.6	-
Calculated Value of Receipts	0.92	0.71	0.93	0.78	1.10	-

Table C-6

SELECTED ICP WORKLOAD FACTORS FOR THE THIRD 30 DAYS (M + 3)

Key Indicator	Inventory Control Point					
	DCSC	DESC	DGSC	DISC	DPSC-M	DPSC-T
Total Requisitions	2.3	5.4	2.8	2.7	1.4	-
Supply Availability	0.78	0.90	0.96	0.89	0.73	-
Calculated Total MRO Lines	1.8	4.9	2.7	2.4	1.0	-
Value of Net Sales	1.9	2.5	1.5	2.0	1.1	-
Calculated Value of Receipts	0.96	0.85	0.98	0.89	0.76	-

In addition to workload resulting from incoming requisitions to the DLA ICPs, certain depots may be impacted because of the Service-owned stocks held there. Research was done using DIDB files to identify these assets, to isolate the depots involved, to determine the total weight involved, and to estimate the number of requisitions that would result from issuing these assets. The only stocks of this kind belonged to DPSC-M. Information

concerning these stocks is presented in Table C-7.

Table C-7

SUMMARY DATA OF SERVICE-OWNED MEDICAL ASSETS

Depot	Tons On Hand	Imputed MRO Lines
DDMP	3733	90481
DDMT	582	8498
DDTC	2534	93862

Since workload is experienced based on the commodity mix of items in store at each depot, additional calculations were required to combine the intermediate results and the depot workload. Keyed to Table C-8 by line number, the subsequent explanation of the calculation for depot DCSC tons received in the first month of the mobilization exemplifies the procedure used to determine depot mobilization planning factors. In the example, the ICP mobilization factors for the first month from Table C-4 are repeated on line one (1) of Table C-8. The annual values for tons received from Table C-1 were divided by 12 to obtain average monthly baseline values, shown on line two. Then, for each commodity, the ICP specific mobilization workload factor on line one was multiplied by the monthly baseline on line two to produce the monthly expected workload for each ICP at depot DCSC. The individual ICP/depot combinations from line three were totalled to give the mobilization workload of tons received at DCSC on line four. The depot total annual value from line two was divided by 12 yielding the normal monthly average workload on line five. The final depot factor comparing the mobilization workload to the normal workload is calculated by dividing line four by line five. This factor appears on line six. Calculations of this nature were made for each of the six depots, in each of three months, and for each of the three planning factor categories — tons received, tons shipped, and lines shipped. Results are presented in Tables C-9 through C-17. For those depots with Service-owned assets, it was assumed that all assets would be depleted in the first 30 days. Handling these stocks would pose an additive burden on DLA depots. Separate lines showing the impact of including these assets are presented.

Table C-8

EXAMPLE OF CALCULATIONS FOR DEPOT FACTOR

	Inventory Control Point					
[line 1]	DCSC	DESC	DGSC	DISC	DPSC-M	
Intermediate Factor for Value of Receipts (from Table C-4)	.84	.77	1.1	.88	1.3	
[line 2]	DCSC	DESC	DGSC	DISC	DPSC-M	TOTAL
Actual FY 84 Workload in 000s of tons at depot DCSC (from Table C-1)	13.8	0	2.7	5.4	0	21.9
[line 3]	DCSC	DESC	DGSC	DISC	DPSC-M	
Calculation resulting from line 1 * line 2 / 12	1.0	0	.2	.4	0	
[line 4]	Monthly Mobilization Workload at depot					
Sum of line 3 values for all ICPs at depot DCSC						1.6
[line 5]	Normal Monthly Workload at depot					
Calculation resulting from Total for entire depot from line 2 or 21.9 / 12						1.825
[line 6]	Depot DCSC Workload Planning Factor for First 30 Days					
line 5 / line 4	.876	rounded to .9				

Note: The values for lines three, four, and six are found in Table C-9 on the line for depot DCSC. Each depot line in subsequent tables is calculated in the same manner for the specific key indicator, month, and ICP values.

Table C-9

SHORT TONS RECEIVED IN MOBILIZATION FIRST 30 DAYS (M + 1)
BY DEPOT AND COMMODITY (in 000s)

Depot	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL	DEPOT FACTOR
	Inventory Control Point						
DCSC	1.0	0	.2	.4	0	1.6	.9
DDMP	.3	.1	.8	1.2	2.2	4.6	1.1
DDMT	.6	0	4.5	1.1	1.4	7.7	1.1
DDOU	.7	.1	3.4	.3	0	4.5	1.0
DDTC	.6	0	2.3	1.2	1.5	5.6	1.0
DGSC	.1	.1	4.6	0	0	4.8	1.1

Table C-10

SHORT TONS SHIPPED IN MOBILIZATION FIRST 30 DAYS (M + 1)
BY DEPOT AND COMMODITY (in 000s)

Depot	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL	DEPOT FACTOR
	Inventory Control Point						
DCSC	2.4	0	.3	.9	0	3.6	1.8
DDMP	.6	.1	1.7	2.8	3.3	8.5	1.7
Service-owned					3.7		
total					7.0	12.2	2.4
DDMT	1.2	0	4.8	2.6	1.8	10.4	1.5
Service-owned					.6		
total					2.4	11.0	1.6
DDOU	1.6	.5	2.9	.8	0	5.8	1.5
DDTC	1.7	.1	4.1	2.8	2.0	10.7	1.6
Service-owned					2.5		
total					4.5	13.2	2.0
DGSC	.1	.3	6.0	0	0	6.4	1.3

The number of receipt lines deserves separate attention. These factors are assumed to be the same as for the tons shipped. The identity of these two factors is due to:

(1) the absence of receipt lines as a report in USIMS and

(2) the assumption that tons and lines would move in tandem during the first 90 days of the mobilization.

Stated simply, the more (fewer) assets received, the more (fewer) the receipt lines at the depots when size and number of buys and returns remain constant. Furthermore, for the 90 day period, the constancy can be expected to apply. The receipt of assets from procurements made at the start of a mobilization takes both administrative and production lead time, usually more than the 90 day horizon critical here. Any change in the size (dollar value) of receipts with the number of receipt lines remaining constant would occur outside the time frame of interest. While returns were hypothesized to drop in both size and number, returns already in the pipeline back to the depots would still arrive as scheduled during the 90 day period (-- constancy condition is met).

Table C-11

LINES SHIPPED IN MOBILIZATION FIRST 30 DAYS (M + 1)
BY DEPOT AND COMMODITY (in 000s)

Depot	Inventory Control Point						
	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL	DEPOT FACTOR
DCSC	134.9	0	1.2	264.2	0	400.3	2.2
DDMP	43.0	145.0	15.6	48.9	66.2	318.7	2.3
Service-owned					90.5		
total					156.7	409.2	3.0
DDMT	91.0	.2	83.7	271.2	45.1	491.2	3.6
Service-owned					8.5		
total					53.6	499.7	3.7
DDOU	109.5	655.7	16.3	226.0	.2	1007.7	3.2
DDTC	32.1	55.1	97.7	99.8	46.2	330.9	2.1
Service-owned					93.9		
total					140.1	424.8	2.7
DGSC	.5	306.4	117.2	.4	0	424.5	3.2

Table C-12

SHORT TONS RECEIVED IN MOBILIZATION SECOND 30 DAYS (M + 2)
BY DEPOT AND COMMODITY (in 000s)

Depot	Inventory Control Point						
	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL	DEPOT FACTOR
DCSC	1.1	0	.2	.4	0	1.7	.9
DDMP	.4	.1	.7	1.1	1.8	4.1	1.0
DDMT	.7	0	3.9	1.0	1.2	6.8	.9
DDOU	.8	.1	3.0	.3	0	4.2	.9
DDTC	.7	0	2.0	1.0	1.3	5.0	.9
DGSC	.1	.1	4.0	0	0	4.2	.9

Table C-13

SHORT TONS SHIPPED IN MOBILIZATION SECOND 30 DAYS (M + 2)
BY DEPOT AND COMMODITY (in 000s)

Depot	Inventory Control Point						
	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL	DEPOT FACTOR
DCSC	2.5	0	.3	.9	0	3.7	1.9
DDMP	.7	.1	1.9	3.0	2.9	8.6	1.7
DDMT	1.3	.0	5.2	2.7	1.6	10.8	1.6
DDOU	1.7	.6	3.2	.8	0	6.3	1.7
DDTC	1.8	.8	4.4	3.0	1.8	11.8	1.8
DGSC	.1	.4	6.5	0	0	7.0	1.5

Table C-14

LINES SHIPPED IN MOBILIZATION SECOND 30 DAYS (M + 2)
BY DEPOT AND COMMODITY (in 000s)

Depot	Inventory Control Point						
	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL	DEPOT FACTOR
DCSC	137.6	0	1.6	369.6	0	508.8	2.7
DDMP	40.8	162.9	21.5	68.4	59.8	353.4	2.6
DDMT	92.8	.2	115.4	379.5	40.7	628.6	4.5
DDOU	116.7	736.6	22.5	316.1	.2	1192.1	3.7
DDTC	32.8	61.9	134.8	139.6	41.7	410.8	2.6
DGSC	.5	344.2	161.6	.5	0	506.8	3.8

Table C-15

SHORT TONS RECEIVED IN MOBILIZATION THIRD 30 DAYS (M + 3)
BY DEPOT AND COMMODITY (in 000s)

Depot	Inventory Control Point						
	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL	DEPOT FACTOR
DCSC	1.1	0	.2	.4	0	1.7	.9
DDMP	.4	.1	.7	1.2	1.3	3.7	.9
DDMT	.7	0	4.1	1.1	.8	6.7	.9
DDOU	.8	.1	3.1	.3	0	4.3	.9
DDTC	.7	0	2.2	1.2	.9	5.0	.9
DGSC	.1	.1	4.2	0	0	4.4	1.0

Table C-16

SHORT TONS SHIPPED IN MOBILIZATION THIRD 30 DAYS (M + 3)
BY DEPOT AND COMMODITY (in 000s)

Depot	Inventory Control Point						
	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL	DEPOT FACTOR
DCSC	2.4	0	.3	.9	0	3.6	1.8
DDMP	.6	.1	1.9	3.0	2.0	7.6	1.5
DDMT	1.2	.1	5.3	2.7	1.1	10.4	1.5
DDOU	1.7	.6	3.3	.8	0	6.4	1.7
DDTC	1.7	.1	4.6	3.0	1.2	10.6	1.6
DGSC	.1	.4	6.7	0	0	7.5	1.6

Table C-17

LINES SHIPPED IN MOBILIZATION THIRD 30 DAYS (M + 3)
BY DEPOT AND COMMODITY (in 000s)

Depot	Inventory Control Point						
	DCSC	DESC	DGSC	DISC	DPSC-M	ROW TOTAL	DEPOT FACTOR
DCSC	123.9	0	1.6	279.7	0	405.2	2.1
DDMP	40.8	163.7	21.8	51.8	52.3	330.4	2.4
DDMT	83.6	.2	116.8	287.2	35.7	523.5	3.8
DDOU	100.6	740.3	22.7	239.3	.1	1103.0	3.5
DDTC	29.5	62.2	136.4	105.6	36.5	370.2	2.3
DGSC	.5	346.0	163.5	.4	0	510.4	3.9

As with the ICP factors, the depot planning factors display considerable flexibility. Since the ICPs often change their distribution causing depot workload to fluctuate while ICP factors stay constant, a depot planner can recalculate these factors based on any other data which might be more

appropriate, rather than the FY 1984 workloads used here.

In conclusion, the depot workload planning factors developed for this iteration of the DLAMP present a slightly altered view of mobilization's impact at the depot level. With the expansion from the previous 30 day to a 90 day time span, the upward trend for both MRO lines and tons out has been confirmed and proves to be even more pronounced than previously anticipated. The values for both lines and tons received show a decreasing trend as opposed to the increases estimated in the previous DLAMP.

<u>Appendix D</u>

Acknowledgements

The following individuals provided important portions of input to the successful completion of this study:

Jim Bailey,	DISC-OBA
Robert Bilikam,	DESC-LO
Ed Fromberg,	DPSC-TMM
Gerry Gavin,	DLA-OS
Forrest Gibson,	DPSC-DHO
Patrick Gray,	DCSC-LOO
Mike Hilert,	DLA-LC
John Hudnall,	DLA-COI
Capt. Dale Kem, USA,	DLA-LO(DORO)
Don Love,	DGSC-OMMR
Raymond Lowe,	DCSC-OMR
John Marth,	DISC-LC
Jonathan McMullen,	DLA-OPM
Lewis Phillips,	DESC-OMP-1
John Sajda,	DPSC-AMM
Calvin Smith,	DLA-LO(DORO)
Eugene Stiff,	DLA-OW.

END

DTIC

5-86